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1 Introduction

This document describes the estimated product lifetimes for the i.MX8M Nano application processors based on the criteria used in the qualification process.

The product lifetimes described here are estimates and do not represent a guaranteed life time for a product.

The i.MX8M Nano series consists of several processors that deliver a wide range of processing and multimedia capabilities across various qualification levels. This document is intended to provide you with guidance on how to interpret the different i.MX8M Nano qualification levels in terms of the target operating frequency of the device, the maximum supported junction temperature (T_j) of the processor, and how it relates to the lifetime of the device.

2 Device qualification level and available PoH

Each qualification level supported (consumer and industrial) defines a number of Power-on Hours (PoH) available to the processor under a given set of conditions such as:

- The target voltage for the application (consumer and industrial).
 - The lifetime is limited by the SOC operating voltage.
- The percentage of active use vs. the suspend mode.
 - Active use means that the processor is running in an active performance mode.
 - For the consumer tier, the maximum performance mode is 1.5 GHz.
 - For the industrial tier, the maximum performance mode is 1.4 GHz.
 - In the suspend mode, the VDD_ARM and the VDD_SOC are lowered, reducing power consumption and junction temperature. In this mode, the voltage and temperature are set low enough so that the effect on the lifetime calculations is negligible and treated as if the device was powered off.
- The junction temperature of the processor (T_j).
 - The maximum junction temperature of the device is different for a given qualification level. For example, 105 °C for the industrial tier and 95 °C for the consumer tier.
 - Ensure that your device is appropriately thermally managed, such that the maximum junction temperature is not exceeded.

All data provided within this document are estimates for PoH that are based on extensive qualification experience and testing with the i.MX8M Nano series. These statistically derived estimates should not be viewed as a limit on an individual device lifetime, nor should they be construed as a guarantee by NXP as to the actual lifetime of the device. Sales and warranty terms and conditions still apply.

2.1 Consumer lifetime estimates

Table 1 provides the number of PoH for the typical use conditions for the consumer device.

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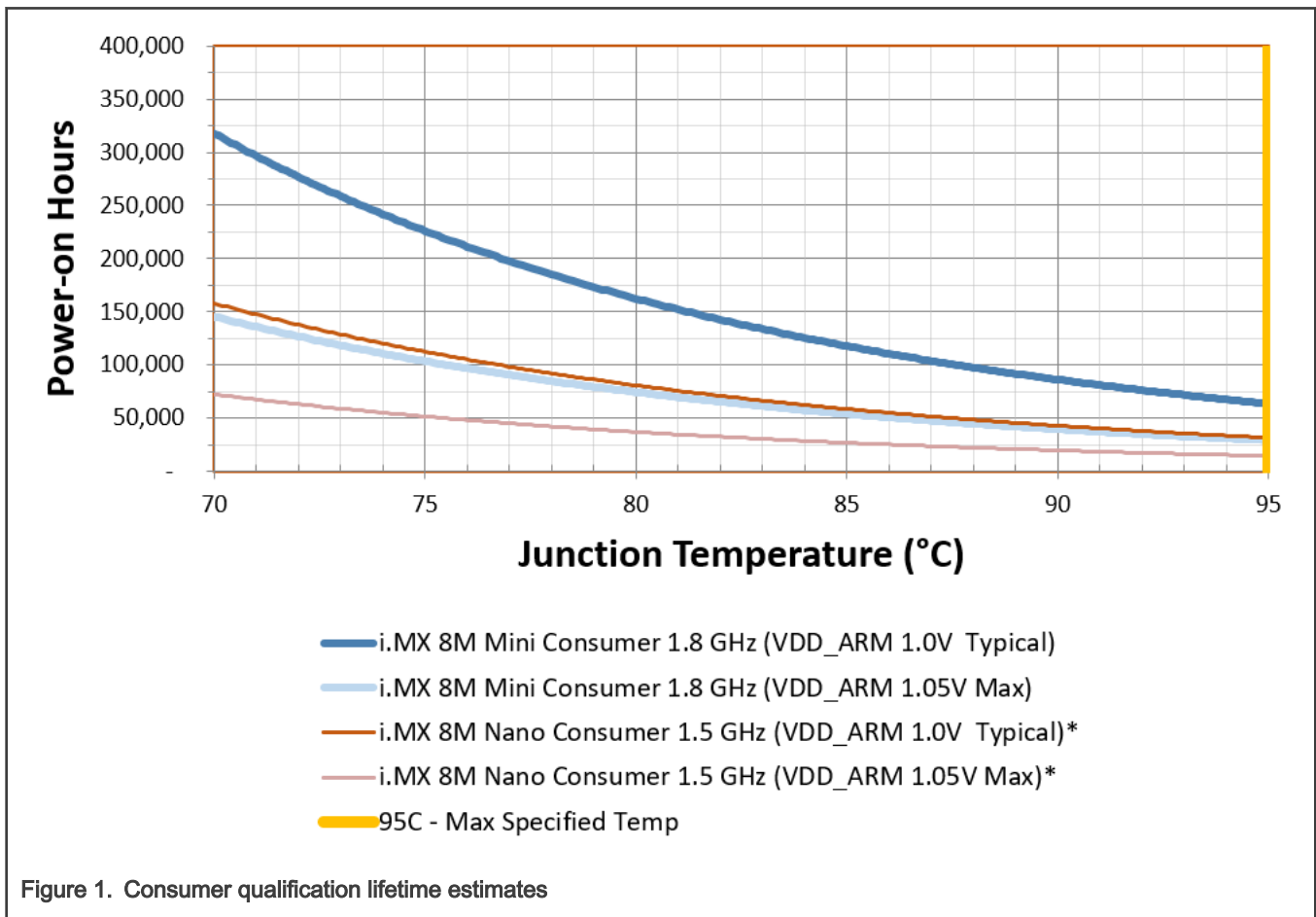
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Table 1. Consumer qualification lifetime estimates

Operating Voltage	Arm Core Speed	Power-on Hours [PoH]	SOC Operating Voltage	Arm Core Operating Voltage	Junction Temperature [Tj]
-	(MHz)	(Hrs)	(V)	(V)	(oC)
Typical	1500	31,644	0.95	1.00	95
Maximum	1500	14,496	1.00	1.05	95

Figure 1 establishes guidelines for estimating PoH as a function of junction temperature. PoH can be read directly from the curves below to determine the necessary trade-offs to the junction temperature at the maximum CPU frequency.



NOTE

The chart includes lifetime data for both the i.MX 8M Mini and Nano products. The apparent lifetime difference on this chart occurs only because the i.MX 8M Mini test plan collected much more product lifetime data over a longer duration than was collected for the i.MX 8M Nano. The chart publishes the i.MX 8M Nano lifetime estimates based on the available data. However, because i.MX 8M Mini and Nano are manufactured using the same process, in the same package, and with similar thermal and lifetime characteristics, it is expected the actual lifetime for i.MX 8M Nano approaches the same PoH as the i.MX 8M Mini.

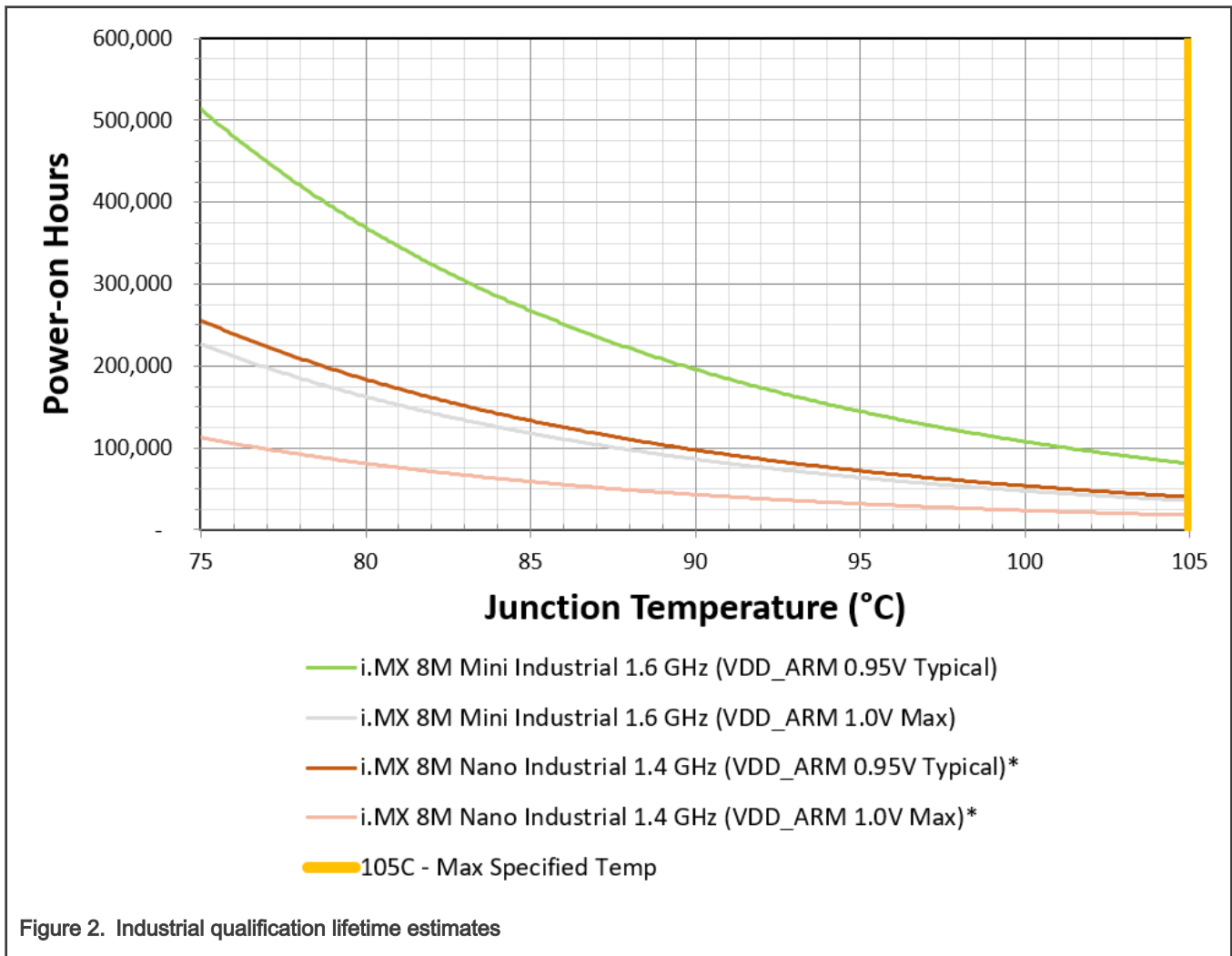
2.2 Industrial qualification

Table 2 provides the number of PoH for the typical use conditions for the industrial device.

Table 2. Industrial qualification lifetime estimate

Operating Voltage	Arm Core Speed	Power-on Hours [PoH]	SOC Operating Voltage	Arm Core Operating Voltage	Junction Temperature [Tj]
-	(MHz)	(Hrs)	(V)	(V)	(oC)
Typical	1 4 00	40,108	0.95	0.95	105
Maximum	1 4 00	17,653	1.00	1.0 0	105

Figure 2 establishes guidelines for estimating PoH as a function of junction temperature. PoH can be read directly from the curves below to determine the necessary trade-offs to the junction temperature at the maximum CPU frequency.



NOTE

The chart includes lifetime data for both the i.MX 8M Mini and Nano products. The apparent lifetime difference on this chart occurs only because the i.MX 8M Mini test plan collected much more product lifetime data over a longer duration than what was collected for the i.MX 8M Nano. The chart publishes i.MX 8M Nano lifetime estimates based on the available data. However, because i.MX 8M Mini and Nano are manufactured using the same process, in the same package, and with similar thermal and lifetime characteristics, it is expected the actual lifetime for i.MX 8M Nano approaches the same PoH as the i.MX 8M Mini.

3 Conclusion

Selecting the optimal operating performance point and thermal envelope is a paramount to meet the application lifetime targets. Trade-offs between the target operating voltage/frequency of the device and the operating junction temperature (T_j) of the processor can greatly improve the lifetime of the device.

Lowering the operating junction temperature in the application is the most effective means to increase the lifetime of the device without affecting the performance of the device. This can be accomplished by increasing the thermal dissipation capacity in the application. In cases where the thermal properties cannot be altered, a lower operating voltage can be used to increase the lifetime of the device. Lowering the voltage may result in lowered performance; the operating frequency may have to be adjusted lower to match the voltage specified in the datasheet.

The data and examples provided in this application note help you to determine the estimated lifetime for their particular application.

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